REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-3, 5-7, 9, 11-15, 17, 19 and 22-41 are presently active in this case, Claims 29, 31-36, 38 and 40-41 amended by way of the present amendment.

In the outstanding Office Action, Claims 33 and 40 were rejected under 35 U.S.C. § 112, second paragraph; Claims 29, 30 and 35-37 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,402,847 to Takagi et al.; Claims 31 and 38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al. in view of WO 01/48790 to Komiya et al.; Claims 32, 33, 39, and 40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al. in view of JP 2001/093699 to Ishii and U.S. Patent No. 6,030,486 to Loewenhardt et al.; and Claims 34 and 41 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Takagi et al.

With regard to the rejection under 35 U.S.C. § 112, second paragraph, Applicants have amended claims 33 and 40 to correct the informalities noted in the outstanding Office Action. Therefore, the rejection under 35 U.S.C. § 112, second paragraph, has been overcome.

Turning now to the merits, Applicants' invention is directed to an exhaust ring for a plasma processing apparatus. Such exhaust rings are positioned around the periphery of the substrate and have a plurality of holes through which process gasses are exhausted from a plasma area to a non-plasma area of the plasma processing chamber. As discussed in Applicants' specification, prior art exhaust rings were problematic in that they allowed plasma to "leak" into a non-plasma region of the processing chamber, thereby reducing the plasma density at a peripheral region of the substrate to be processed (and more generally

reducing uniformity of plasma characteristics).[1] While attempts have been made to address these problems by reducing the overall area of the through holes in the exhaust plate, such a design undesirably reduces the vacuum exhaust efficiency of the plasma chamber.[2] Applicants disclosed invention is directed to addressing these problems.

For example, as seen in the embodiment of the present invention shown in the vertical sectional view of Fig. 15, exhaust holes (314a, 314b, 314c) penetrating the exhaust ring (focus ring 306) are circular holes each of which extend linearly, and have a diameter which is substantially constant from the upper end of each exhaust hole to the lower end thereof. However, the diameter (opening area) of a hole is smaller at positions toward a center region of the exhaust ring, while the diameter of the holes gradually increases at positions toward the outer peripheral region of the exhaust ring. That is, in the example of Fig. 15, the opening areas of the exhaust holes satisfy the following size relationship: 314a < 314b < 314c. In such a manner, those three types of exhaust holes having different opening areas are arranged concentrically in three rows. As discussed in Applicants' specification, this arrangement allows reduced plasma leakage, while maintaining an acceptable exhaust efficiency.

In order to expedite issuance of a patent in this case, Applicants have amended independent Claims 29 and 36 to clarify the patentable features of the present invention over the cited references. Specifically, Applicants' Claims 29 and 36 recite that the exhaust ring has a plurality of exhaust holes that extend linearly and are arranged in concentric rows such that opening areas of the exhaust holes vary from one concentric row to another to increase from an innermost one of the concentric rows to an outermost one thereof. Thus, the claimed invention can provide reduced plasma leakage, while maintaining an acceptable exhaust efficiency as discussed above.

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[1] Applicants' Specification at p. 3, lines 13-23.
[2] Applicants' Specification at p. 3, lines 23-31.

In contrast, the primary reference to Takagi et al. is directed to a baffle plate having a prolonged life before deposits are able to close off holes in the baffle plate. As seen in the vertical sectional view Fig. 13, a slit 133 is tapered such that its diameter increases from an air-intake side to an air exhaust side. As shown in Fig. 14, the tapered arrangement is intended to increase the time required before a product adhering to the slit 133 can close it off. Various other arrangements are shown in Figs. 17-20. Therefore, while the baffle plate of Takagi et al. has slits having the same opening area in the air-intake side, and also has slits having the same opening area in the exhaust side, since each slit is tapered the opening area of the air-intake side of each slit is different from that of the exhaust side. Thus, Takagi et al. does not disclose a plurality of exhaust holes that extend linearly (i.e., not tapered) as now required by independent Claims 29 and 36.

Moreover, there is no indication in Takagi et al. that the size of the baffle plate through holes vary according to radial position on the baffle plate. Therefore, Takagi et al. also does not disclose that the plurality of exhaust holes which extend linearly are concentrically arranged in three rows, and the rows are different in opening area of the exhaust hole from each other such that the opening areas of the exhaust holes gradually increase from the inner peripheral side of the exhaust ring toward the outer peripheral side thereof.

For the reasons discussed above, Applicants' independent Claims 29 and 36, as amended, patentably define over the cited references. As claims 30-35 and 37-41 depend from Claims 29 and 36 respectively, these claims also patentably define over the cited reference to Takagi et al. Nevertheless, Applicants dependent claims further remove the claimed invention from the cited prior art.

Claims 31 and 38 recite that the exhaust ring has a plate thickness that varies concentrically. Fig. 15 of Applicants' specification shows an embodiment covered by these

claims. As seen in this Fig., the exhaust ring is formed in a stepwise manner such that a thickness of the exhaust ring gradually increases from the inner peripheral side of the ring in which exhaust holes having the smallest diameters are formed, toward the outer peripheral side of the ring in which exhaust ring having the greatest diameters are formed. The cited reference to Komiya et al. (Fig. 12) apparently discloses only circumferential thickness variation and therefore cannot meet the limitations of Claims 31 and 38. These claims have been amended to clarify this feature.

As seen in Fig. 16 of Applicants' specification, magnets 350 are provided on the exhaust ring to prevent leakage of plasma, and the thickness of the exhaust ring 313 can be made smaller than in the case where no magnet is provided. Thus, as a whole, the conductance of the exhaust ring 313 can be improved, as compared with the case where the magnets 350 are not provided. In addition, a magnetic field is produced by the magnets provided at the exhaust ring, and causes charged particles in the plasma to turn, and collide against the inner walls of the exhaust holes 314a, 314b and 314c, thereby preventing leakage of the plasma. Claims 32, 33, 39 and 40 are directed to covering these embodiments. The cited references do not disclose these features in combination with the linear through holes and varying hole sizes discussed above.

Finally, Claims 34 ad 41 recite a particular size of exhaust through hole. The office action takes the position that the exhaust holes can be easily optimized by a combination of Takagi et al. and Gardner v. TEC System, Inc. Applicants' submit, however, the present invention cannot be achieved even by combining Takagi et al. with any other reference, since the baffle plate having tapers slits formed therein disclosed in Takagi et al. is different from the exhaust ring of the present invention in which exhaust rings are arranged in rows such that the opening areas vary from one row to another to increase in stages. Further, it is settled law that a particular parameter must first be recognized as a result-effective variable,

i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). There is no indication in any of the cited references that variation in hole size can provide any advantage for the plasma processing system.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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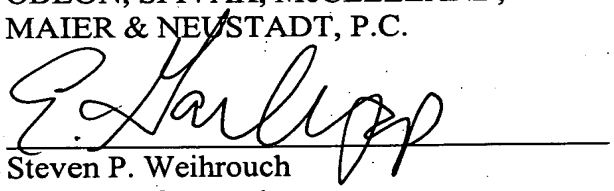

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